

Development of an Instrument to Measure the Acceptance of Internet Technology by Consumers

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Abstract

This research reviews studies using the Technology Acceptance Model (TAM) in order to create a modified model and instrument to study the acceptance of Internet technology by consumers. In this paper, we examined the relationships between the TAM constructs in some of the research that purports to explain the variance in the acceptance of different information technologies. Based upon the empirical research using the technology assessment model, a modified TAM was developed for the acceptance of Internet-based technologies by consumers. The original constructs (beliefs, attitudes, behavior and use) were retained from the TAM while the literature suggests gender, experience, complexity, and voluntariness to be useful antecedents for predicting perceived usefulness, perceived ease of use and behavioral intent to use. Hypotheses were discussed in this study related to the theoretical relationships between constructs and antecedents. A survey instrument was developed using existing scales from prior TAM instruments and modifying them where appropriate. The resultant instrument can be used in future research to test how consumers adopt and accept Internet-based applications.

1. Introduction

This paper describes the development of an instrument designed to measure the acceptance of Internet technologies by consumers. This instrument is designed to be a tool for the study of the assimilation of Internet-based applications by individuals and the technology's diffusion from the organization to the consumer. Significant progress has been made over the last decade in explaining and predicting user acceptance of information technologies. In particular, substantial theoretical and empirical support has accumulated for the Technology Acceptance Model (TAM) (Davis et al. 1989). Numerous studies have found that TAM is a model that consistently explains a substantial proportion of variance in usage intentions and behavior, among a variety of technologies. It is also found that TAM performs well against alternative models such as the Theory of Reasoned Action (TRA) and the Theory of

Planned Behavior (TPB) (Mathieson, 1991; Sun, 2003). TAM theorizes that an individual's behavioral intention to use a technology is determined by two beliefs: perceived usefulness and perceived ease of use. TAM has become a well-established and robust model for predicting user acceptance. TAM is one of the most influential research models in studies of determinants of information systems/information technology acceptance. (Chau, 1996).

While there has been extensive research on the Internet in the past five years, determinants of Internet usage and acceptance have not been abundant. Only a small number of these studies have been conducted on Internet technology. Most of the studies focus on a certain factor and add or change one part of the TAM. The purpose of this study is (1) to apply the TAM to Internet technology and (2) to bring together several external factors that have been tested in prior studies into a more comprehensive model, and (3) develop an instrument to measure the acceptance of Internet-based applications. Our efforts in this research are to perform a comprehensive analysis of technology assimilation and acceptance of Web-based Internet technologies using existing TAM theory and studies. Based upon this analysis, we suggest a modified model that includes antecedents and outcome measures (perceived usage) that many studies did not include. We then selected the articles that contained studies relevant to Internet technology and those that contained constructs appropriate for our technology. Hypotheses are derived and a survey instrument created for later investigation.

2. Literature Review

In this section, we focus on a key set of studies centered around technology assimilation and technology acceptance constructs. While we realize that there are a wider set of studies that reference technology assimilation and technology acceptance, we analyzed those that have advanced or modified the Technology Acceptance Model for specific technologies. We report the results of those studies as well as show the models. Based upon this theory, we propose a model of customer acceptance of Internet technologies.

2.1. Technology Assimilation

Assimilation is defined as the extent to which the use of a technology diffuses across organizational processes or society and becomes an integral part of the tasks associated with those processes (Cooper and Zmud 1990; Fichman and Kemerer 1997). Many researchers have focused on the importance of the causality between the organizational adoption of an information technology and its impacts on business performance (DeLone and McLean 1992; Jarvenpaa and Ives 1991; Sethi and King 1994). There have been numerous studies in the past twenty years on the adoption and assimilation of information technologies. Fichman and Kemerer (1999) suggest that information technologies exhibit an assimilation gap, where their rates of organizational assimilation trail behind their rates of organizational adoption.

Swanson (1994) purported a taxonomy of IS innovations where he suggests that information technologies follow three different pathways of organizational adoption: type 1 innovations (to enhance the efficiency of the IS function), type 2 innovations (to enhance the efficiency of administrative functions in the organization), and type 3 innovations (to enhance the competitiveness of the organization). Chatterjee et al. (2002) suggest that the majority of IS research has sought to examine the predecessors and associated relationships of type 1 and type 2 IS innovations (for example, Purvis et al. 2001; Karahanna 2000; Taylor and Todd 1995). It is particularly more difficult to study type 3 innovations predominantly due to the more sophisticated and complex set of organizational relationships and environment, rather than the IS functional leaders (type 1 innovations) or members of a workgroup or department (type 2 innovations). Agarwal and Sambamurthy (2002) suggest that the assimilation of type 3 innovations, such as e-business initiatives, appears to be guided by a distributed leadership model consisting of senior management, business executives, and IS executives collectively responsible for decision making for IS initiatives.

Consistent with Chatterjee et al. (2002) and Purvis et al., it seems reasonable to consider organizational culture with respect to the assimilation of type 3 innovations since decision making is a result of the “cumulative consequence of the actions of managers and departments across the organization.” Van de Ven (1986) stated that organizations can foster higher levels of technological assimilation by

shaping, influencing, and motivating individual management attention, cognition, and behaviors toward more assimilations initiatives across the enterprise. “Whereas assimilation itself is the cumulative result of actions by individuals and units within the firm, these actions are stimulated by an organization milieu of norms, values, and rules.”

2.2. Technology Acceptance Model

The Technology Acceptance Model (TAM) is an adaptation of TRA specifically tailored for modeling user acceptance of information systems (Davis et al. 1989). The model provides a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions (Davis et al., 1989). The two main constructs of TAM are perceived usefulness and perceived ease of use (see Figure 1). Perceived usefulness is defined as the extent to which a person believes that using a technology will enhance her/his productivity and perceived ease of use is the extent to which a person believes that using a technology will be free of effort. TAM posits that behavioral intention determines actual systems use and behavioral intention is determined by both attitude and perceived usefulness. Perceived usefulness and perceived ease of use both have an effect on behavioral intention. Perceived ease of use also affects perceived usefulness. Behavioral intentions are influenced indirectly by external variables through perceived usefulness and perceived ease of use. The relative strength of the usefulness- usage relationship versus the ease of use-usage relationship was a significant finding and particularly important for designers. Users need to perceive the system as being useful or they will not attempt to use it regardless of how easy or difficult it is to use. Ease of use is less important because difficulty in using a system can be overcome if the user thinks that the system will be useful to them. Overall the model explained 47% of the overall model’s variance. Davis modified his original TAM model (corroborating the finding of Mathieson) where he found a stronger support of perceived ease of use construct with perceived usefulness rather than with intention to use.

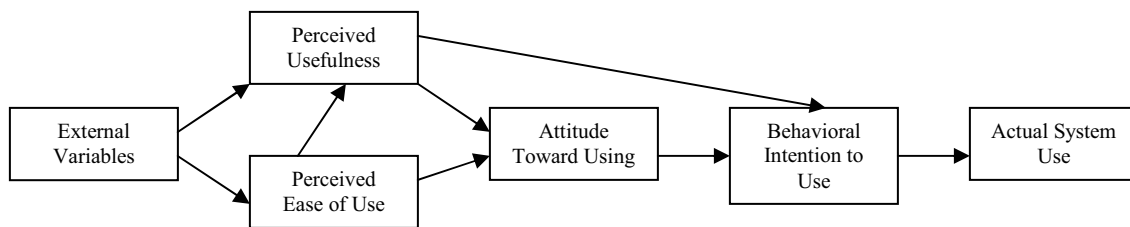


Figure 1. Technology Acceptance Model (TAM)

Mathieson (1991) compares two models: the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). Both models predict intention to use an IS. The models were compared on three criteria: (1) how well do they predict the user's intention to use an IS; (2) how valuable is the information provided by the model; and (3) how difficult are the models to apply. Three main differences were found to exist between TAM and TPB. First, the degree of generality varies. The beliefs that are involved in the TPB model are specific to each situation. Whereas, the TAM assumes that beliefs about usefulness and ease of use are always primary determinants of use decisions. The second difference is the lack of social variables in TAM. Davis (1989) argues that social norms will be taken into account in the outcome evaluations. However, TPB may be able to account for some variance in intention by including social variables. Third, each model treats behavioral control differently. TAM's ease of use construct encompasses behavioral control, but only the internal control factors. TPB includes the control variables for each situation independently. Mathieson found that both models explain intention well, but that TAM explained more variance than TPB, however these results were not significant enough statistically to consider one model better than the other. Mathieson concludes that TAM explained attitude much better than TPB. TAM is quick and inexpensive, but provides more general information, whereas TPB provides more specific information.

Since 1994, there have been a large block of studies that utilized the technology acceptance model for empirically-based research. The Szajna (1994) study found that the perceived usefulness/ease-of-use (U/EOU) instrument demonstrates reasonably good predictive validity. The U/EOU instrument has been shown to be reliable and valid for (1) intentions to use, (2) self-report usage, (3) self-predicted usage, (4) attitudes toward use, and (5) choice. Here the construct for self-report and self-predict usage is introduced. In the pre-implementation version, intentions predict self-report usage but do not predict actual usage; whereas in the post-implementation version, perceived usefulness directly affects self-report usage. Chin and Todd (1995) applied structural equation modeling (SEM) to the original Davis model analyzing just the usefulness construct as one-factor or two-factor explanatory interactions. The results of the cross validation analyses also suggest that the one-factor model fits the "true population" model better than the two-factor model.

Taylor and Todd (1995) developed a modified TAM focusing on assessing the efficacy of the augmented TAM in helping, a priori, to understand the behavior of experienced/inexperienced users. The results from the study reveal that there are significant differences in the relative influence of the determinants of usage depending on experience. It is also revealed that the augmented TAM can be used to predict subsequent usage behavior for inexperienced users. It was found that perceived usefulness was the strongest predictor of intention for the inexperienced users. Whereas, experienced users' strongest predictor was perceived behavioral control. They also found a strong link between behavioral intention and behavior for experienced users.

Chau (1996) modified the Technology Acceptance Model to differentiate between perceived near-term usefulness and long-term usefulness. The model was simplified by taking out the "attitudes" construct of the original TAM (a trend that followed in many of the TAM studies subsequent to this study). Contrary to previous studies, this study found that ease of use had no statistically significant influence on intention to use. However, ease of use was found to be a significant factor affecting perceived near-term usefulness. This finding supports the original TAM in that an individual's intention to use depends on perceived usefulness, not on ease of use.

The objective of Igbaria, Parasuraman, and Baroudi's study (1996) was to examine the influence of three motivators on an individual's choice to use a computer: (1) perceived usefulness, (2) perceived enjoyment/fun, and (3) social pressure. The two indicators of microcomputer usage that were used in this study were (1) self-reported daily use of microcomputers, and (2) self-reported frequency of microcomputers. The results also show the importance of perceived usefulness, perceived enjoyment, and social pressure in mediating the relationships of antecedent variables and perceived complexity on microcomputer usage. The results support the threefold motivational model and help in explaining the relationships between perceived usefulness, perceived enjoyment, social pressure, and microcomputer usage. The study also reveals that perceived complexity is an important variable in linking skills, organizational support, and organizational usage with perceived usefulness, perceived enjoyment, and social pressure. It was also recognized that organizational support is important in promoting wider usage of microcomputers.

Gefen and Straub (1997) examined gender differences in regards to the IT diffusion model and the technology acceptance model (TAM) extending the TAM by also studying the constructs of perceived social presence and information richness (SPIR) addendum. They found that women tend to be more cooperative in their conversation and men tend to be more competitive and that women view e-mail as being higher in social presence than men. They also found that women purport a higher value for perceived use than men. In looking at gender in regards to perceived ease of use, they found the opposite result of what they had hypothesized. However, this result is supported by other research which indicates that men are more at ease in using computers than women are. It was not confirmed that women perceive a higher social presence and usefulness of e-mail.

Agarwal and Prasad (1998) developed a modified TAM model that focused on the perceptions of technology usefulness and ease of use based on the idea that personal innovativeness positively moderates the relationship between the perceptions of relative advantage, ease of use, and compatibility and the decision to adopt an innovation. It was found that there are moderating influences on the perceptions to intentions link which is absent in much technology acceptance research and that communications channels play a significant role in innovation adoption.

Compeau, Higgins, and Huff (1999) developed a model based on Bandura's Social Cognitive Theory to study the influences of self-efficacy, performance and personal outcome expectations, affect, and anxiety on

computer usage. A relationship between personal outcome expectations and affect was not supported, rather a negative relationship was found between personal outcome expectations and use. They found that self-efficacy explains a total of 18% of the variance in an individual's usage. The implications of this study reveal the importance of managing self-efficacy and computer usage through training programs and other support mechanisms.

Agarwal and Karahanna (2000) further developed the concept of self-efficacy to analyze the relationship between self-efficacy and perceived usefulness and perceived ease of use. Adding the cognitive absorption construct, they further modified the TAM model from Agarwal's original study (1998). The three aspects of cognitive absorption research are the personality trait dimension of absorption, the state of flow, and the notion of cognitive engagement. The study was done using the World Wide Web and university students. PLS was used to establish the nomological validity of cognitive absorption. The hypotheses that cognitive absorption is a significant predictor of perceived usefulness and perceived ease of use were supported by the results. They also found that playfulness and personal innovativeness have strong significant effects on cognitive absorption.

Through an extension of the technology acceptance model (TAM), Van der Heijden (2000) examines the individual acceptance and usage of a website adding two new constructs: perceived entertainment value and perceived presentation attractiveness. The relationships between perceived usefulness, perceived entertainment value and website revisit were found to be significant. Conversely, the relationships between ease of use, perceived attractiveness, and website usage were not significant. This study revealed that perceived usefulness and perceived entertainment value are both significant factors in determining Website usage. Perceived entertainment value contributes to the length of visit more than perceived usefulness. The findings also reveal that ease of use only indirectly influences website usage through usefulness and that attractiveness indirectly impacts website usage through entertainment value.

Venkatesh and Davis (2000) extend the original TAM to include social influence and cognitive instrumental processes. TAM2 hypothesizes that three social influences will affect an individual's decision to accept or reject an IS: subjective norm, voluntariness, and image. In four longitudinal field studies, TAM2 was strongly supported. It explained up to 60% of the variance in perceived usefulness as a determinant of user intentions. An interesting finding was that job relevance and output quality had an interactive effect between them. The effects of social influence processes and cognitive instrumental processes were consistent with TAM2.

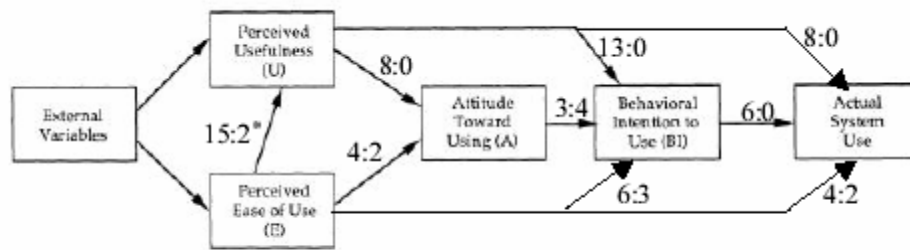
Chau and Hu (2001) compared three models in this study; the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and a decomposed TPB model that is potentially adequate in the targeted healthcare professional setting in Hong Kong. The results indicated that TAM was superior to TPB in explaining the

physicians' intention to use telemedicine technology. The decomposed TPB performed slightly better than TAM and the findings revealed that perceived usefulness was the most significant factor for the physicians' technology acceptance while perceived ease of use was not a significant factor. Subjective norms were found to have no significant influence on behavioral intention. However, perceived behavioral control had a significant effect on behavioral intention. Finally, compatibility was found to be a significant factor for perceived usefulness, but not for perceived ease of use.

3. Analysis of TAM Models

Legris, Ingham, and Collette (2003) examined IS implementation through an analysis of the TAM studies. They consulted 80 articles for analysis of the TAM and found a high proportion of positive results for all relations of the TAM components with some inconsistencies. In most TAM studies, a regression model has been used for predicting use. In many of the studies, self-reporting was used to measure use. As for external variables, there is no clear pattern. Their marginal influence helps in understanding the variance in system use. Through meta-analysis, it was revealed that the research findings were heterogeneous except in one grouping - by type of software and only for students. The limitations of the TAM research include the involvement of students, the type of applications, and self-reported use. They conclude that TAM's predictive capacity may increase if organizational and social factors were included in the model.

Sun (2003) conducted a study analyzing the TAM model research models (see Figure 2). He found that the perceived ease of use shows significant effect on perceived usefulness in 15 studies, but not studied in direct relationship with attitude toward using, behavioral intention to use or actual system use, as in most of the research. Experience using was found to have mediating effects between the relationships of ease of use and perceived usefulness. Perceived usefulness was confirmed as the most important factor affecting all of the constructs related to user acceptance of a variety of technologies. Both gender and experience were found to have mediating effects on perceived usefulness on user acceptance. Sun found that overall the construct behavioral intentions to use to be a good predictor of usage, however it should be noted that many studies did not measure the actual system use construct in their studies. Attitude toward using cannot be considered a reliable predictor of behavioral intention to use, since in the seven studies analyzed, only three found a significant relationship to behavioral intention to use. There was a significant number of antecedents, expressed as external factors, for both perceived usefulness and perceived ease of use and some of these factors were found to be mediators of certain constructs within the TAM model.



Note: number of study in which the relationship is significant: number of studies in which the relationship is non-significant

Figure 2. Sun (2003) Analysis of TAM Relationships

4. Modified TAM for Internet-Based Technologies

The Technology Acceptance Model has been used to test the degree of acceptance with a wide variety of technologies. It could be argued that TAM provides a better overall fit with certain technologies than with others. Overall, the relationships may differ between constructs in TAM based upon the technology being studied. Based upon the study of TAM constructs, we propose a model from which to study the impacts of these constructs on the consumer-based adoption patterns. The modified TAM (see Figure 3) proposed consists of the original TAM with the external variables broken down into four items: gender, experience, complexity, and voluntariness. We hypothesize that each of the four items will have a significant external or moderating effect on perceived Internet usage. Prior studies have revealed the individual influence of each of these items (Davis, 1989; Taylor & Todd, 1995; Gefen & Straub, 1997; Venkatesh and Davis, 2000). We offer related hypotheses based on the TAM theoretical foundation of research.

4.1. Original TAM Variables

4.1.1. Perceived Ease of Use of the Internet

Perceived ease of use is the degree to which an individual believes that using a particular system would be free of physical and mental effort. Perceived ease of use has been found to influence usefulness, attitude, intention, and actual use (Chau, 1996). Davis et al. (1989) found that perceived ease of use directly and indirectly affects usage through its impact on perceived usefulness through the attitude toward using the Internet. Chau's study revealed that perceived ease of use significantly affected near-term usefulness, but did not significantly affect intention to use. Venkatesh and Davis (2000) found that TAM2 retains perceived ease of use from TAM as a direct determinant of perceived usefulness.

H1: Perceived ease of use of the Internet is positively correlated to perceived usefulness of the Internet and attitude toward using the Internet.

4.1.2. Perceived Usefulness of the Internet

Perceived usefulness is based on expectancy theory which is concerned with an individual's beliefs in the decision making process (Fishbein & Azjen, 1975). Perceived usefulness is the degree to which an individual believes that using a particular system would enhance his or her performance. Davis (1989) found that the relationship between perceived usefulness and usage was stronger and more consistent than other variables reported in prior studies. Individuals evaluate the consequences of their behavior in terms of perceived usefulness and base their choice of behavior on the desirability of the usefulness (Chau, 1996). Szajna found a significant relationship between perceived usefulness and self-report usage in her study of 61 graduate business students (1996), however not hypothesized in her revised TAM. In studying personal computing acceptance in small firms, Igarria et al. (1997) found that perceived usefulness had a strong direct effect on usage. Usefulness has been confirmed to be the most important factor affecting user acceptance with few exceptions (Sun, 2003).

H2: Perceived usefulness of the Internet is positively correlated to attitude toward using the Internet, behavioral intention to use the Internet, and perceived usage of the Internet.

4.1.3. Attitude Toward Using the Internet

Attitude toward using is the user's evaluation of the desirability of his or her using the system (Mathieson, 1991). The attitude toward using is an individual's positive or negative feelings about performing the target behavior (Davis et al. 1989). Sun (2003) found that attitude is not a reliable predictor of behavior to use or usage. Although many studies have focused on behavior rather than attitude as an indicator of user acceptance, Mathieson found that attitude construct was statistically valid for explaining intention to use, comparing the Theory of Planned Behavior with the TAM. Taylor and Todd (1995) found that attitude is not a significant determinant of behavioral intention although the relationship between attitude and behavioral intention is more significant for experienced users. Chau and Hu (2001) found perceived usefulness to be a significant determinant of attitude as well as behavioral intention. These findings show that users are likely to have a positive attitude if they believe that usage

of a technology will increase their performance and productivity. Since we are measuring the experience with which users interact with the Internet, we have included attitude toward using in our modified TAM.

H3: Attitude toward using the Internet is positively correlated to behavior toward using the Internet.

4.1.4. Behavioral Intention to Use Internet

Behavioral intention is a measure of the strength of one’s intention to perform a specified behavior. Sun reports that behavioral intention is a good predictor of actual usage of a technology which has received numerous empirical support from prior studies (Davis et al., 1989; Taylor and Todd, 1995; Venkatesh and Davis, 2000). One of the conclusions of the study by Davis et al. (1989) was that people’s computer use can be predicted reasonably well from their intentions (1989). Therefore, any factors that influence behavior are indirect influences through behavioral intention (Davis, 1989). The results of Taylor and Todd’s study of inexperienced and experienced users confirmed that there is a stronger correlation between behavioral intention and behavior (usage) for experienced users (1995).

H4: Behavior toward using the Internet is positively correlated to perceived usage of the Internet.

4.1.5. Perceived Usage of the Internet

Straub et al. (1995) found that system usage has a notable practical value for managers interested in evaluating the impact of information technology. Igarria et al. (1995) defined perceived usage as the amount of time interacting with a technology and the frequency of use. They found strong relationships with behavioral intent to use the technology. Igarria et al. (1997) found that individuals are likely to use a system if they believe it is easy to use and will increase their performance productivity.

Actual usage, as originally conceptualized in the Davis (1989) study, was measured by the frequency of use and the length of time of use. Objective measures of actual use are difficult to obtain for Internet-based technologies and therefore many of the TAM studies either left out usage as a dependent variable, focusing solely on behavioral intention or else moved to perceived usage. Szajna (1994) recommended the examination of self-reported usage. Sun (2003) reports that most TAM studies used a perceptual self-report usage.

4.2 External Variables

4.2.1. Gender

Gender differences exist in many disciplines, including technology. In studying the gender differences in the perception and use of e-mail, Gefen and Straub (1997) found that women’s and men’s perceptions of technology differ. Women view e-mail as being higher in social presence than men and women placed a higher value on perceived usefulness than men. Also, their study supported the idea that men tend to feel more comfortable with computers. In another study by Venkatesh and Morris (2000), it was discovered that men’s decisions were strongly influenced by their perceptions of usefulness; whereas, women were more affected by the perceptions of ease of use and subjective norm. However, they concluded that men consider perceived usefulness to a greater extent than women in making their decisions regarding the use of a new technology. This study showed that men perceive the system to be easier to use with more experience.

H5: Gender will influence the perceived use of the Internet, perceived usefulness of the Internet, and perceived usage of the Internet.

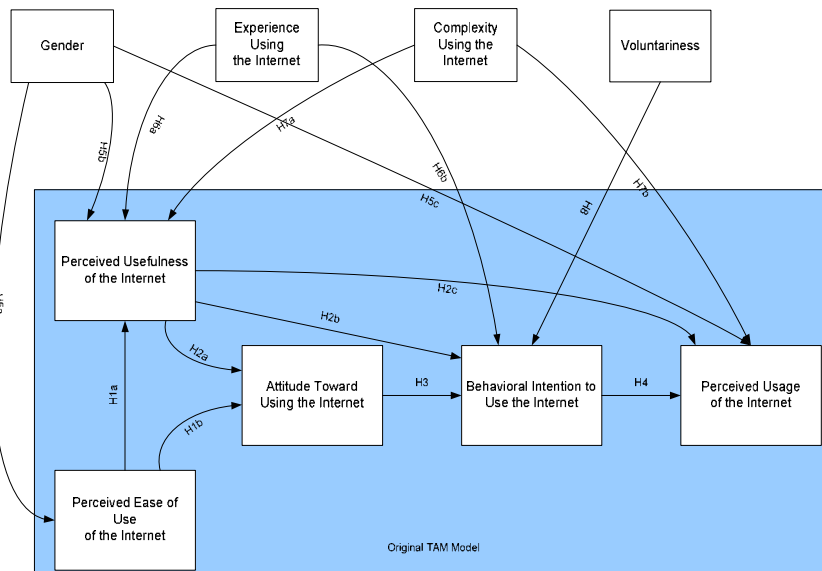


Figure 3. Proposed TAM Model for Internet-Based Applications

4.2.2 Experience

Prior research has shown that prior experience is a determinant of behavior (Ajzen & Fishbein, 1980). It was found that there are significant differences between experienced users and inexperienced users in the influence of the determinant of usage. For experienced users, there was a stronger link between intentions and usage (Taylor & Todd, 1995). Also, perceived usefulness was the strongest predictor of intention for the inexperienced group in the same study). The results of Taylor and Todd's study of inexperienced and experienced users confirmed that there is a stronger correlation between behavioral intention and behavior (usage) for experienced users.

Venkatesh and Morris (2000) found that as direct experience with technology increases over time, individuals have a better assessment of the benefits and costs associated with using that technology. Igbaria et al. (1995) found that computer experience will directly and indirectly affect usage through beliefs and that individual skills and expertise were related to user beliefs and usage. They found that computer experience and user training were positively associated with perceived ease of use and perceived usefulness. Igbaria et al. (1996) found that the use of computer technology depends on the technology itself and the level of skill or expertise of the individual using it. The relationship between experience, expressed as skills or expertise, was empirically supported by Mathieson (1991) and Thompson et al. (1991). Venkatesh and Davis (1996) found that the perceived ease of use of a system measured after hands-on experience will be system specific and hence, significantly different from measures taken before hands-on experience. Agarwal and Prasad (1999) report a strong relationship an individual's prior experience with similar technologies and their behavior to use that technology. Szakna (1996) found that as an individual becomes more experienced with the information technology, usefulness directly determines not only intentions to use but also the usage behavior.

H6: Experience using the Internet will be correlated to perceived usefulness of the Internet and the behavioral intention to use the Internet.

4.2.3. Complexity

Complexity is defined as the degree to which the user expects the technology to be free of effort. Perceived complexity is defined as the degree to which computer technology is perceived as relatively difficult to understand and use (Rogers and Shoemaker, 1971). Davis (1989) and Igbaria et al. (1996) measured complexity in terms of time taken to perform tasks, integration of computer results into existing work, and vulnerability. Thompson, et al. (1991) found that the more complex the innovation, the lower the rate of adoption. Although Thompson et al. felt that complexity as perceived by users could be the opposite of ease of use, Igbaria, et al. (1995) found strong relationships between perceived complexity and perceived usefulness and with usage. Complexity parallels ease of use quite closely (Davis, 1989). Chau and Hu (2001) reported that the more complex the technology, the less relevant experience and subsequently a weaker link exists between perceived usefulness and behavioral intention to use. We

hypothesize that complexity will be negatively related to Internet usage and ease of use will be positively related.

H7: Perceived complexity of using the Internet will be correlated to perceived usefulness of the Internet and the perceived usage of the Internet.

4.2.4. Voluntariness

The level of voluntariness is defined as the extent to which potential adopters perceive the adoption decision to be non-mandatory (Venkatesh & Davis, 2000). Organizations often require their employees to use a certain technology. However, some people will not agree to follow such regulations. In the Venkatesh and Davis study, they found that voluntariness has a moderating effect on the subjective norm on intention to use. Therefore, behavioral intentions vary between mandatory and voluntary usage (Sun & Zhang, 2003). Moore and Benbasat (1991) suggest that it is not necessarily actual voluntariness which will influence behavior, but rather a perception of voluntariness. Innovations diffuse because of the cumulative decisions of individuals to adopt them. It is not the potential adopters' perception of the innovation itself but their perceptions of using the innovation that are key to how rapidly the innovation diffuses. Venkatesh and Morris (2000) found that in the context of technology acceptance in voluntary usage settings, the influence of other users will diminish to non-significance over time with increasing experience with the target system. Sun and Zhang (2003) found that voluntariness is considered a moderating factor in shaping behavioral intention to use.

H8: Voluntariness of using the Internet is positively related to the behavioral intention to use the Internet.

5. Measurement Scales

Theoretical constructs were operationalized using validated items from prior research (see Appendix). After extensive research of TAM, several studies were used in prior TAM studies (Agarwal & Karahanna, 2000; Chau, 1996; Igbaria et al., 1995; Igbaria et al., 1996; Igbaria et al., 1997; Legris et al., 2002; van der Heijden, 2000; Venkatesh & Davis, 2000). The survey is presented in the appendix. The TAM scales of perceived usefulness, perceived ease of use, and behavioral intention were measured using adapted from Davis, et al. (1989) and Chau (1996). *Perceived usefulness of the Internet* included measuring the enablement of the ability to accomplish tasks more quickly, improvement in performance, using the Internet to increase productivity and enhancing effectiveness. *Perceived ease of use* measured the easiness to learn to use the Internet, getting what is needed, interacting with the Internet in a clear and concise manner, ease of flexibility, and respondents' ease to become skillful. Measures of *attitude toward using the Internet* were derived primarily from the Agarwal and Karashanna study (2000) where they looked at fun and enjoyment interacting with the technology. We examined the *behavioral intention to use the Internet* as combination of carrying out the task and planned utilization in the future (Chau, 1996 and Agarwal and Karashanna, 2000). We used the Venkatesh and Davis (2000) measures examining behavioral inclinations now (T1) and in the future (T2).

The external variables include the perceived complexity using the Internet, experience, voluntariness using the Internet, and gender. The *perceived complexity* construct was derived from Igbaria, et al. (1996) where they measured the amount of time it takes to perform task, the integration of the results into existing work, and the exposure of the Internet to the vulnerability of computer breakdowns and a loss of data. The *experience* construct was operationalized from the research of Venkatesh and Davis (1996, 2000) and Legris, et al. (2002) where the perceived experience using the Internet is measured in conjunction with the number of years using the Internet. *Voluntariness* using the Internet was derived from the Venkatesh and Davis (2000) research where they looked at the requirement to use the technology for work or school and where it enhances tasks where there is not a requirement to use it. We measured *gender* as a single-item as suggested by Gefen and Straub (1997).

The *actual usage* variable for this technology was a perceptual measure due to the difficulty in obtaining actual logged data. Though some research suggests that self-reported usage measures are biased (Straub et al. 1995), other research suggests that self-reported usage measures correlate well with actual usage measures (Taylor and Todd, 1995, Venkatesh and Davis, 2000). As suggested by Venkatesh and Davis, we minimized the potential problem with the common-method variance resulting from measuring both self-reported usage and its determinants (intention, perceived usefulness, etc.) with single-item measures.

6. Conclusion

The technology acceptance model is one of the most accepted theories for explaining the assimilation of technologies. Assimilation is defined as the extent to which the use of technology diffuses in an organization and within a society. The technology acceptance model is an adaptation of the theory of reasoned action specifically tailored for modeling user acceptance of information systems. This study analyzed existing research using the TAM model in order to develop a reasonably grounded modified model for testing the acceptance of Internet technology by consumers. Studies using the TAM were analyzed for model definitions, constructs, and scales in order to assess the construct validity of scale items. The technologies for which the TAM was utilized were examined and the statistically significant correlations analyzed. An analysis of TAM studies by Legris et al. (2003) and Sun (2003) revealed significant relationships between each of the constructs. Based upon these findings, a modified technology acceptance model was developed for Internet-based applications. In this model, we analyzed the constructs and their underlying theory including relevant findings as well as relationships between these constructs as related to the Internet-based applications. The basic constructs of Perceived Ease of Use, Perceived Usefulness, Attitudes toward Using, Intentions to Use, and Actual Systems Use were retained in this study. External variables are included in the survey instrument based upon the relevance of the construct and the impact of the variables

on the Internet technology. A set of hypotheses resulting from established theory was purported in this research.

A survey instrument for future study was developed to ensure content validity. Davis et al. (1989) pointed out, psychometricians emphasize that the validity of a measurement scale is built from the outset. To ensure content validity of the scales, the items selected must represent the concept about which generalizations are to be made. First, all items identified in existing instruments were categorized according to the various TAM scales published in the literature. This generated an initial item pool for each construct. To keep the length of the instrument reasonable, we selected three to six scales for the measurement of each of the constructs, keeping the wording similar to the original studies. The typical item in previous instruments tended to be a statement to which the respondent was asked to indicate a degree of agreement. This approach was retained for this study, with a five-point Likert scale ranging from "strongly disagree" to "strongly agree" chosen as the response format. Once the item pools were created for each construct, these items were re-evaluated to eliminate those items that appeared redundant or ambiguous, which might load on more than one factor in subsequent research.

The technology acceptance model adaptation and instrument development research described here offers several contributions. The most obvious is the creation of an overall instrument to measure the various perceptions in the adoption of Internet-based technologies. The creation process included surveying known existing instruments, choosing appropriate items, revising items as necessary, and then undertaking an extensive scale development process. We believe that the method of developing the scales will result in a high degree of confidence in their content and construct validity for measuring the acceptance of Internet technology by consumers. This instrument, comprising all of the original TAM constructs (including attitude toward using) and additional external variables, antecedents, and moderators related to the technology in study can now be used to investigate how consumers adopt and accept Internet-based applications.

The development process also helped to clarify and refine some of the definitions used by a variety of researchers using the technology acceptance model. The development steps showed the importance of Experience Using the Internet as a variable affecting both the Perceived Usefulness of the Internet and the Behavioral Intention to Use the Internet. Voluntariness was also found to be correlated to the Behavioral Intention to Use the Internet. Perceived Complexity Using the Internet may be significantly related to the Perceived Usefulness (as is the Perceived Ease of Use) and directly impact Perceived Use. Finally, Gender may play an important role in the both of the "belief" variables as well as directly on Perceived Use of the Internet. We plan to validate this instrument using a pilot study and later, after appropriate testing for validity and reliability, conduct a more detailed study on the acceptance of Internet technologies.

In recommending this instrument to researchers investigating the acceptance of Internet-based technologies, we caution that its use is tailored for Web-enabled applications. Therefore the wording of the scales reflects

our specificity toward this type of technology. Future research includes testing this modified model with the instrument created to ascertain how consumers can more effectively assimilate Web-base technologies. We feel that this research could enhance an organization's ability to determine how well its consumer base will accept their Internet initiatives.

7. References

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APPENDIX

Scales Derived for Modified TAM

Perceived Usefulness of the Internet

PU1	Using the Internet can enable to accomplish tasks more quickly
PU2	Using the Internet can improve my performance
PU3	Using the Internet can make it easier to do my tasks
PU4	Using the Internet in my job/school can increase my productivity
PU5	Using the Internet can enhance my effectiveness
PU6	I find the Internet useful in my job/school

Perceived Ease of Use

PE1	Learning to use the Internet is easy for me
PE2	I find it easy to get what I need from the Internet
PE3	My interaction with the Internet is clear and understandable
PE4	I find the Internet to be flexible to interact with
PE5	It is easy for me to become skillful at using the Internet
PE6	I find the Internet easy to use

Attitude Toward Using the Internet

AT1	I have fun interacting with the Internet
AT2	Using the Web provides me with a lot of enjoyment
AT3	I enjoy using the Web
AT4	Using the Web bores me

Behavioral Intention to Use the Internet

BI1	I always try to use the Internet to do a task whenever it has a feature to help me perform it
BI2	I always try to use the Internet in as many cases/occassions as possible
BI3	I plan to use the Internet in the future
BI4	I intend to continue using the Web in the future
BI5	I expect my use of the Web to continue in the future

Perceived Complexity Using the Internet

PC1	Using the Internet can take up too much of my time when performing many tasks
PC2	When I use the Internet, I find it difficult to integrate the results into my existing work
PC3	Using the Internet exposes me to the vulnerability of computer breakdowns and loss of data

Experience

EX1	I have a great deal of experience using the Internet
EX2	Number of years using the Internet

Voluntariness Using the Internet

VU1	Using the Internet is voluntary as far as work/school is concerned
VU2	I am not required to use the Internet for work/school
VU3	While the Internet enhances effectiveness in completing tasks, it is not required that I use it

Gender

	Male or Female
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